Transport attitudes, residential preferences, and urban form effects on cycling and car use.

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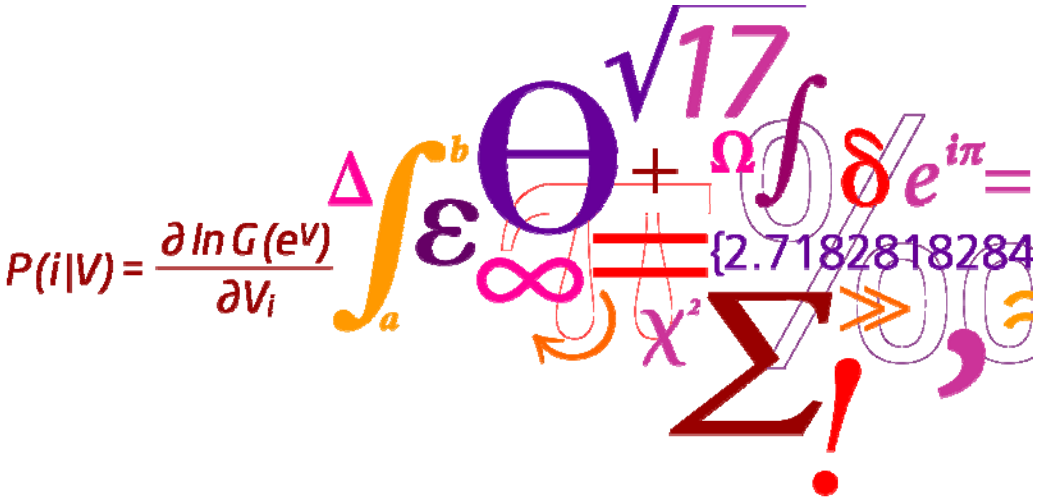


Agenda

- Context and question
- Methodology and survey
- Urban form and location
- Datareduction
- Main analysis of travel mode
- Conclusions

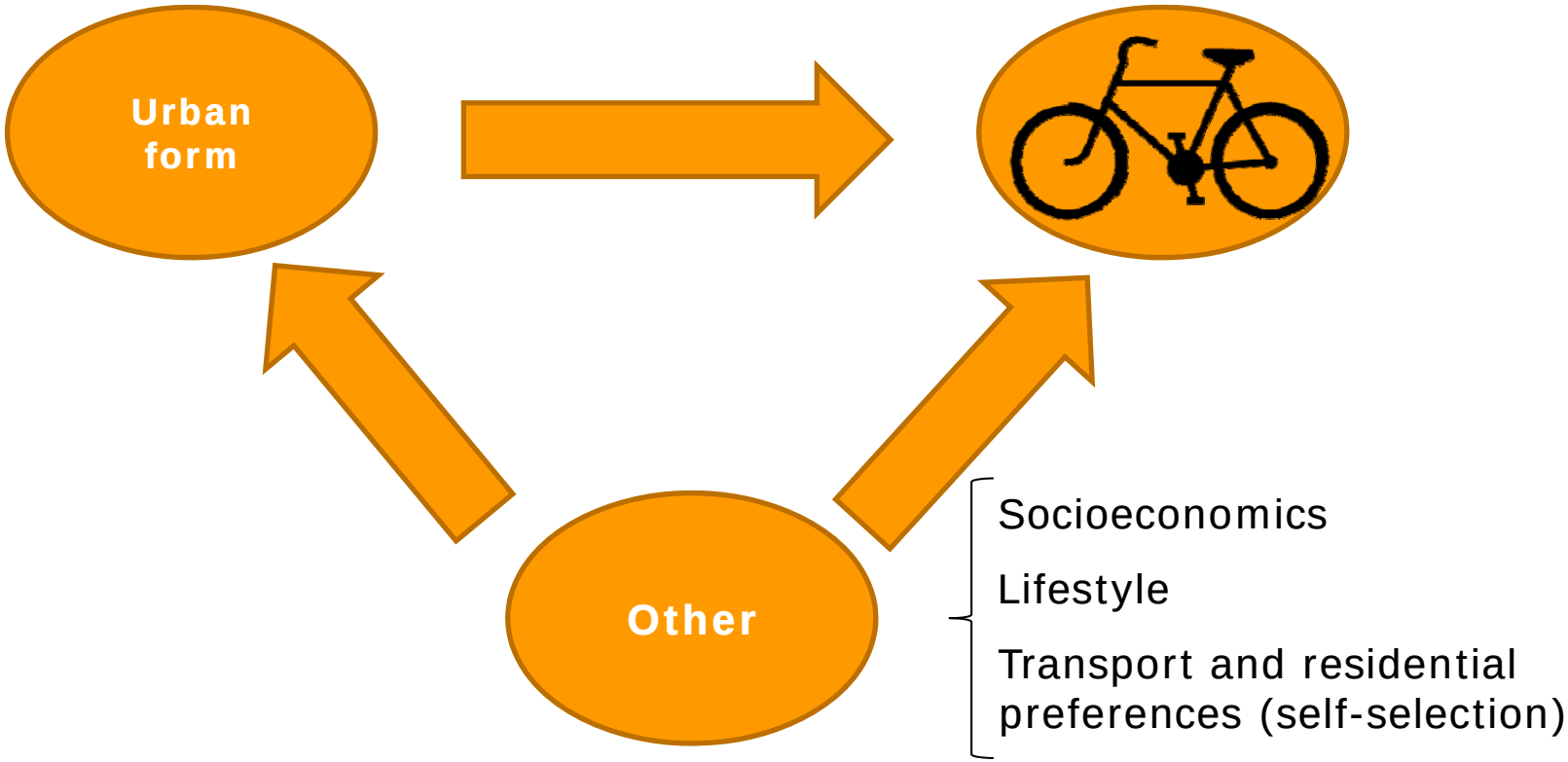
Research context and question

- *Bikeability WP1: Cycling behaviour and its preconditions*

- analyse the determinants for cycling behaviour of individuals, such as motives, lifestyles, opportunities and constraints.
- emphasis is on the role of critical factors for cycling in the population as a whole, including also regional and urban context and the contribution of '*Bikeability*'.

- *Which urban form and location factors are correlated with cycling in the Denmark? What differences in 'bikeability' can be derived?*

Urban form and cycling - basic analysis problem



Multi-layered approach

1) Developing and implementing a survey
2) Measuring and adding objective urban form and location variables to the data
3) Datareduction within urban form, attitude and residential preference variables
4) Analysis of mode use based on urban form, attitude and preference scores; and socio-economic background variables.

Dependent variables:

- Cycling as main mode
- Cycling for public transport
- Walking as main mode
- Car driving alone
- Car driving with others /carpooling

Measured in days of mode use per week

Bikeabilitys cycling and transport survey

- Setting cycling in context of other travel behaviours and activities
- Relating cycling to urban form – taking lifestyle and self selection aspects into consideration.
- Analysing cycling in Theory of Planned Behaviour framework.
- Analysing cycling routes and experiences (national sample and recreational emphasis).

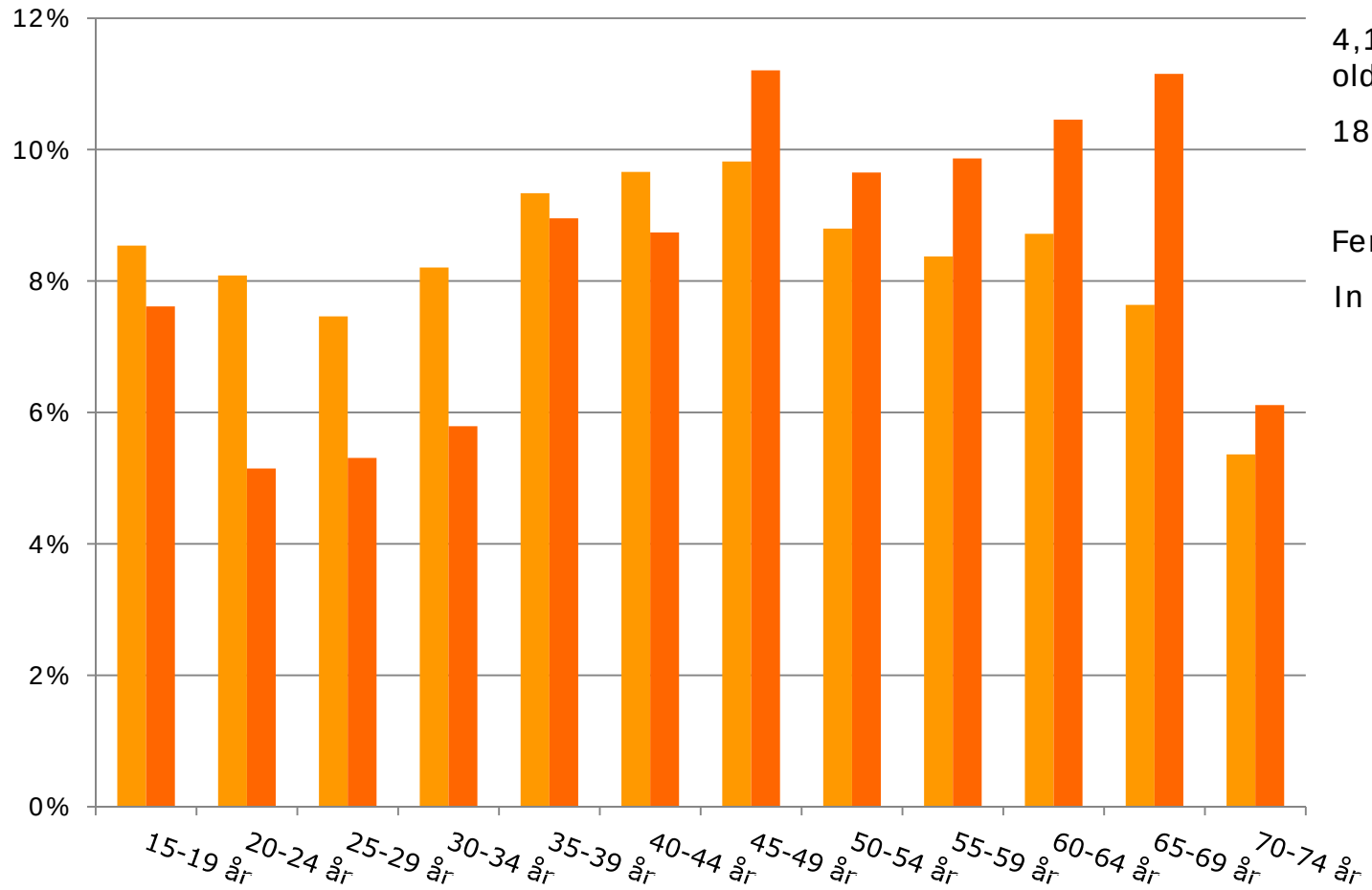
Topics of the survey

- Activities, transportation and cycling habits
- Residential preferences
- Health indicators (BMI + non-cycling physical activity)
- Behavioral intentions towards cycling
- Subjective norm
- Perceived behavioral control (including perception of policy/planning interventions)
- Attitides towards cycling
- Background information (income, education, household type etc.)

Survey implementation

- Contact data for representative sample of 6000 15-75 year olds living in Denmark aquired from 'Sundhedsstyrelsen' (Danish register of persons). Due to contact constraints registered in CPR register we were only allowed to contact 5124 of the sample.
- 5124 respondents were invited to participate by conventional mail mid September 2011. The survey closed November 22nd.
- The survey was developed and tested as online survey.
- A total of 1970 respondents have responded fully or partially to the questionnaire. A reponserate of 38%.
- Given the survey format and response rates in other transportation surveys this is highly satisfactorily.

Comparing survey respondents to population



4,17 Mill 15-75 year olds in DK

1865 in survey

Females in DK: 50%

In survey: 52%

Weekly and daily participation in cycling

Age group	Weekly: Bikeability survey*	Daily: NTS survey**
16-29	71%	35%
30-44	55%	21%
45-59	51%	21%
60-69	52%	20%
70-75	49%	17%

*Bikeability survey 2011: September-November (N=1970)

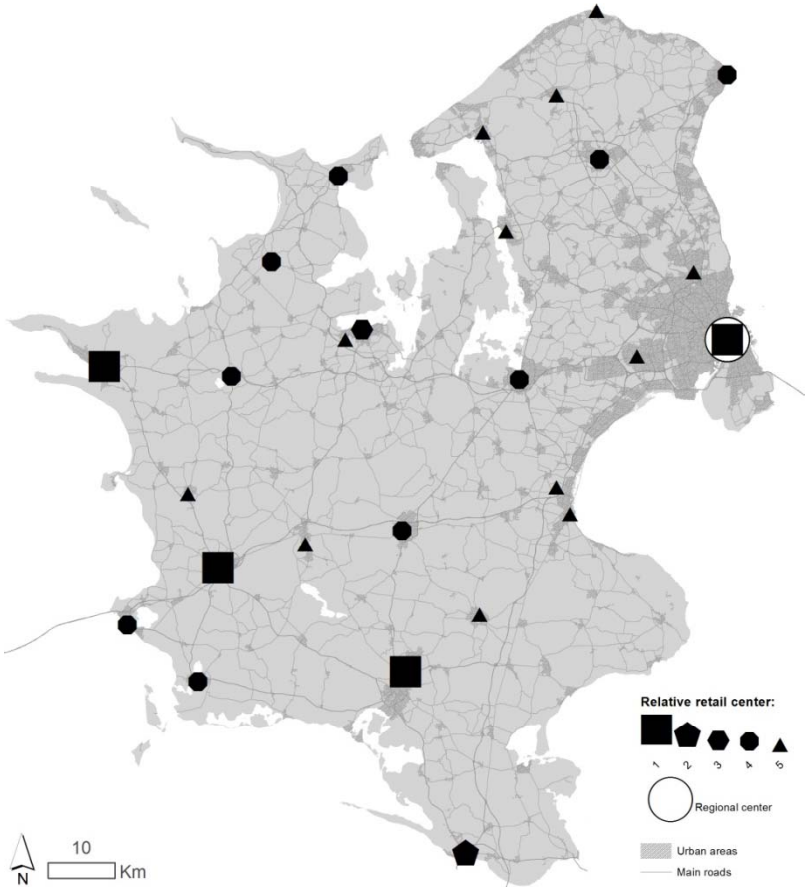
**National travel survey 2009/2010; 2010/2011: August-November (N=13902)

Urban form and location measures

- Density
- Diversity
- Design
- Destination accessibility
- Distance to transit
- Demand management

(Ewing and Cervero 2010)

- Measured based on spatially explixit datasets and assigned to survey respondents by their home address.



Walkability variables (Frank et al. 2010)

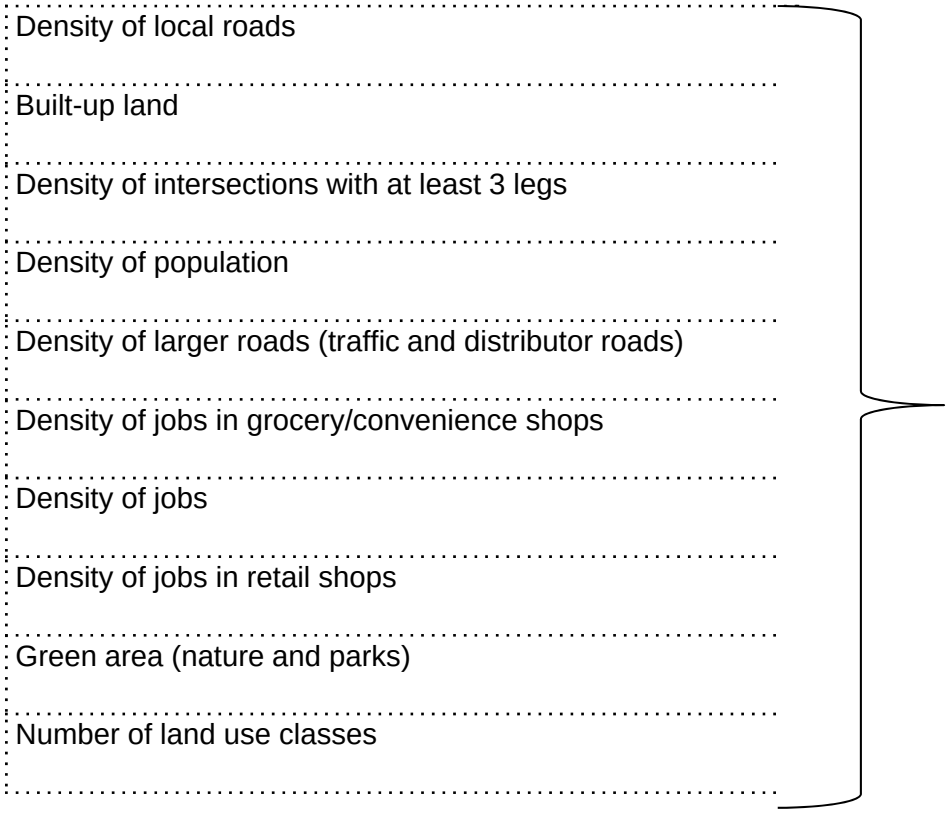
- Density:
  - population, jobs, retail jobs - within 500 m and 1500 m
- Floor area ratio:
  - build percent within 150 m; 250 m; 500 m
- Intersection density:
  - Intersections, network composition, and density within 500 m and 1500 m
- Land use mix:
  - mix of land use categories (Corine); jobs to population, and retail to population ratios within 500 m and 1500 m

Important issues

- 'Spatial autocorrelation'
  - Points towards datareduction

- 'MAUP: Modifiable Areal Unit Problem'
  - Points towards emphasizing spatial scales

Urban form in 1500 m neighbourhoods



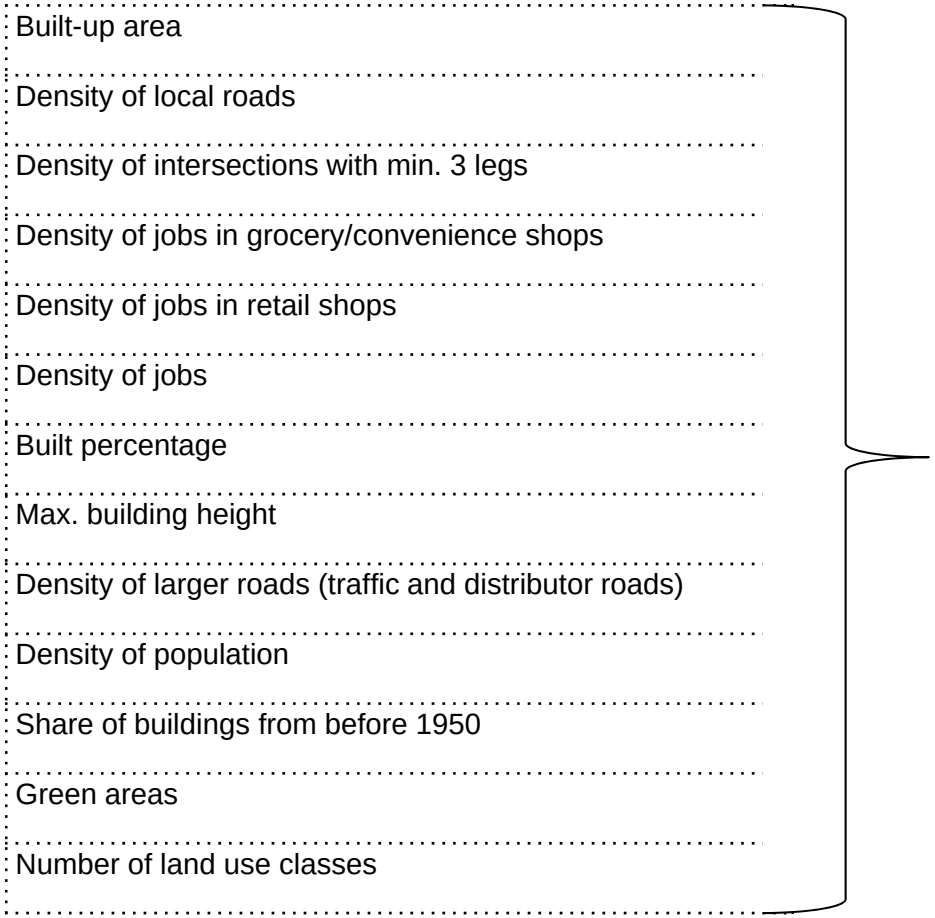
1) Density and connectivity of urban land uses

2) Density of employment and retail

3) Land use variation, nature and green areas

Explaining 84% of variation

Urban form in 500 m neighbourhoods



1) Population density and connectivity of urban land uses

2) Density of employment and retail

3) Dense, old, with high densities of traffic and distributor roads

4) Land use variation, nature and green areas

Explaining 71% of variation

Cycling and car use attitudes

- Cycling is a flexible/independent mode of transport
- Cycling is a fast mode of transport
- Cycling is first and foremost a cheap mode of transport
- Cycling is a troublesome/exhausting mode of transport
- On a bicycle, I experience personal freedom
- Cycling is important for my health
- It's important to me that my choice of transport is environmentally friendly
- On a bicycle, I can experience urban life and nature
- Cycling is a fashionable mode of transport
- The car is a flexible/independent mode of transport
- When I travel by car, I experience personal freedom
- The car is a practical mode of transport, allowing me to travel with others, transport goods, etc.
- Travelling by car, I can experience urban life and nature
- The car is a fashionable mode of transport

1) Cycling positive

2) Car positive

3) Appearence/experience

Emphasis

Explaining 57% of variation

Political opinions / beliefs

Cycling is an essential element of Danish culture

Limiting car use in urban areas would increase quality of life

Politicians/society would like more people to use bicycles

Cycling makes a significant contribution to society
(e.g., better environment or enhanced public health)

Everyday life makes it necessary for most people to go by car

Society depends on car-based transport

1) Cycling positive and car reduction

2) Car reliance and nessessity

Explaining 58% of variation

Transport / access conditions as residential preferences

Parking and private garden

Access to a garden

Parking access

Possibility to walk or cycle to parks or nature areas

Cycling, walking and public transport

Shops withing walking or cycling distance

Short distances to public transport

Possibility to have a transport pattern based on cycling or walking

Residential preferences

- Access to a private garden
- Ease of parking
- Parks or nature areas within walking or cycling distance
- Shops within walking or cycling distance
- Short distance to public transportation stops
- The possibility of relying on walking or cycling for daily transport

1) Walking, cycling and short distances

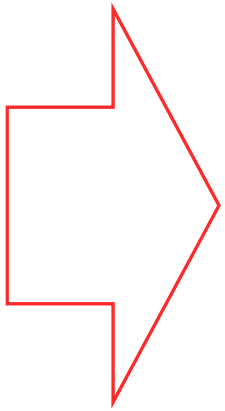
2) Private gardens and car parking

Explaining 65% of variation

Main analysis of travel modes

Independent variables (groups)

- Socio-economic background
- Bicycle and car attitudes
- Transport policy opinions
- Residential preferences
- Urban form within 1500 m
- Urban form within 500 m
- Regional location and access to public transport



Dependent variables

- Cycling as main mode
- Cycling for public transport
- Walking as main mode
- Car driving alone
- Car driving with others/carpooling

Main results table

		Cycling as main mode	Cycling for public transport	Walking as main mode	Car driving alone	Car travel with others
Socio-economic background	Age under 30 (0,1)	.059*				
	Driver's license (0,1)		-.055*		.092***	
	Education: higher/university (0,1)				-.062**	
	Household size (persons)					.061*
	Household: single person (0,1)				.048*	-.105***
	Children <10 in household (0,1)				-.053*	.068**
	Personal income (Ln DKK/year)				.162***	-.094***
	Household income (Ln DKK/year)			-.066*		
	Full-time employed (0,1)			-.233***		
	Part-time employed (0,1)			-.071**		
	Student (0,1)	.070**	.118***	-.162***	-.062*	
Attitude variables	Attitude, comp.1	.390***	.101***		-.220***	-.096***
	Attitude, comp.2	-.123***	-.051*	-.072**	.152***	.080**
	Attitude, comp.3	-.073***	.050*			
	Policy, comp.2	-.096***			.094***	
Urban form variables	1500m. neighbourhood, comp.1	.238***	-.091***			
	1500m. neighbourhood, comp.2	.066**	-.073**			
	500m locale, comp.1	-.065*		.106***		
	500m. locale, comp.2			.087***		
	500m. locale, comp.3			.087**	-.071**	-.058*
	500m. locale, comp.4	.041*		.088***	-.043*	
Residential preferences	Residential preference, comp.1	.024	.113***	.030	-.198***	.002
	Residential preference, comp.2	-.037	-.091**	.051	.111***	.082**
Distance to train station	Train-station within 1000m (0,1)					-.064*
	Commuter ('S-') train station within 1-2000m (0,1)		.118***			
	Commuter ('S-') train station within 2-3000m (0,1)		.053*			
	Adjusted R-square	*0.357*	*.087*	*.090*	*.371*	*.077*

Conclusions on attitudes and preferences

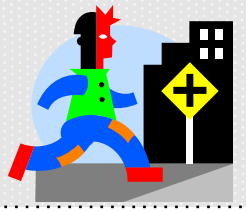
- Attitudes contributes to the explanation of all mode uses
- Structural difference between cycling and car use – indicating overruling importance of attitudes for cycling compared to car use where 'traditional' socio-economic' variables are also important.
- Insignificant effects of residential preferences per-se on cycling and walking as main mode – but strong effects of urban form.

Conclusions on urban form

- Cycling, walking and car use also appear to be significantly related to the built environment – even when residential preferences and attitudes.
- Built environment appear to be (considerably) more important in explaining cycling and walking – than in explaining car use.
- There are scale differences in how built environment relate to travel. Cycling responds to built environment attributes at a larger geographical scale than walking.
- Car-driving also seem to respond to the built environment within a convenient walking range.

	Cycling as main mode	Cycling for public transport	Walking as main mode	Car driving alone	Car travel with others
Population density and connectivity of urban land uses within 1500m.	.238	-.091			
Density of employment and retail within 1500 m	.066	-.073			
Population density and connectivity of urban land uses within 500m	-.065		.106		
Density of employment and retail within 500m			.087		
Dense, old areas with traffic and distributor roads within 500m.			.087	-.071	-.058
Land use variation, nature and green within 500m	.041		.088	-.043	
Train-station within 1000m (0,1)					-.064
Commuter (’S-’) train station within 1-2000m (0,1)		.118			
Commuter (‘S-‘) train station within 2-3000m (0,1)		.053			

Urban form effects and scales

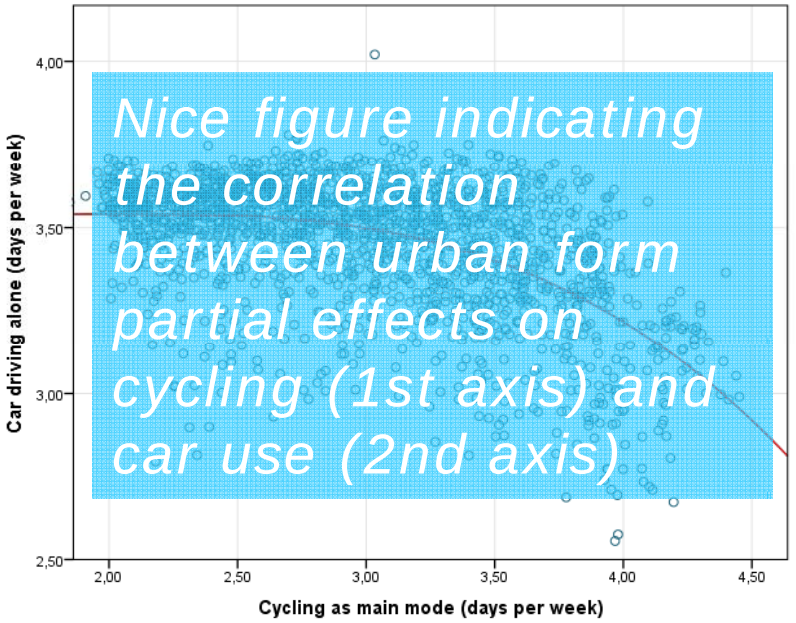
			
1500 m scale: **Population density and connectivity of urban land uses within *1500m.***	.238		
1500 m scale: **Density of employment and retail within *1500 m***	.066		
500 m scale: **Population density and connectivity of urban land uses within *500m***	-.065	.106	
500 m scale: **Density of employment and retail within *500m***		.087	
500 m scale: **Dense, old areas with traffic and distributor roads within *500m***		.087	-.071
500 m scale: **Land use variation, nature and green within *500m***	.041	.088	-.043

Cycling and car use and urban form

- Scale differences and differences in the importance of built environment factors points to indirect relations between cycling/walking and car driving
- Cycling may be encouraged without affecting car driving.
- Car use seems to require a high degree of convenience of not driving – by means of very short distances.

•20% of variation in cycling as main mode, is explained by urban form

•6% of the variation in car driving alone is explained by urban form variables.

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